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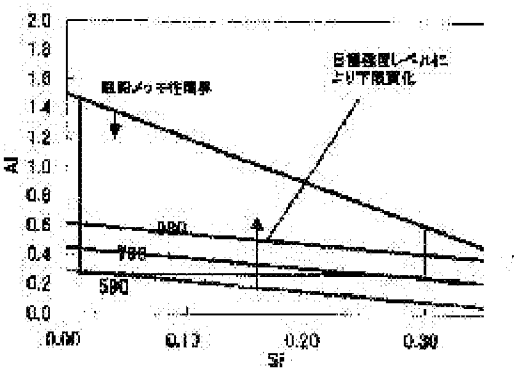
(54) GALVANIZED HIGH STRENGTH STEEL SHEET HAVING EXCELLENT FORMABILITY AND PRODUCTION METHOD THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To realize a galvanized high strength steel sheet which has excellent formability, and to realize a production method therefor on industrial scales.

SOLUTION: The galvanized high strength steel sheet having excellent formability has a composition containing, by mass, 0.01 to 0.30% C, 0.005 to 0.3% Si, 0.1 to 3.3% Mn, 0.001 to 0.06% P, 0.001 to 0.01% S, 0.0005 to 0.01% N and 0.25 to 1.8% Al, and the balance Fe with inevitable impurities, and in which the mass% of Si, Mn and Al also satisfies the following inequality (A), and has a metallic structure containing ferrite and martensite: (0.0012×[TS target value]-0.29-[Si])/1.45<Al<1.5-3*[Si] (A); wherein, the [TS target value] is the designed strength value of the steel sheet in a unit of MPa, and the [Si] is the mass% of Si.



* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1]At mass %, it is C. : 0.01 to 0.30%, Si : [0.005 to 0.3%,] Mn: 0.1 to 3.3%, P : 0.001 to 0.06%, S : 0.001 to 0.01%, :0.0005-0.01%, aluminum : Contain 0.25 to 1.8%, consist of the remainder Fe and an inevitable impurity, and further N Si and mass % of aluminum, A molten zinc plating high intensity steel plate excellent in a moldability, wherein an intensity value (TS) of an aim satisfies following (A) type and a metal texture contains a ferrite and martensite.
(0.0012x [TS target value]-0.29-[Si])/1.45 -- < -- aluminum<1.5-3* [Si] ... (A) -- here -- [TS target value] -- an intensity designed value of a steel plate -- a unit -- Mpa and [Si] -- mass [of Si] % [Claim 2] V:0.01 to 0.1%, Ti:0.01-0.2%, Nb: A molten zinc plating high intensity steel plate excellent in the moldability according to claim 1 containing two of one sort or 0.005 to 0.05% of sorts or more.
[Claim 3]Mo: A molten zinc plating high intensity steel plate excellent in the moldability containing 0.05 to 0.5% according to claim 1 or 2.
[Claim 4]Ca : 0.0005 to 0.005%, REM: A molten zinc plating high intensity steel plate excellent in the moldability according to claim 1 to 3 containing two of one sort or 0.0005 to 0.005% of sorts.
[Claim 5]A molten zinc plating high intensity steel plate excellent in the moldability containing B:0.0005 to 0.002% according to claim 1 to 4.
[Claim 6]Are a manufacturing method of the high intensity steel plate according to claim 1 to 5, and it heats in a molten zinc plating process in one or more Ac(s) temperature region of 3+100 ** or less of Ac(s), A manufacturing method of a molten zinc plating high intensity steel plate which was excellent in a moldability cooling to a temperature region 600 ** or less with a cooling rate at 1 **/s or more after holding 30 or less minutes 30 seconds or more.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a molten zinc plating high intensity steel plate excellent in the moldability, and a manufacturing method for the same.
[0002]
[Description of the Prior Art]In recent years, the weight saving of the body is further demanded for the fuel consumption improvement of a car. Although what is necessary is just to use steel materials with high intensity for the weight saving of the body, press forming becomes difficult, so that intensity becomes high. This is because the yield stress of steel materials increases and also elongation falls, so that the intensity of steel materials generally becomes high. On the other hand, to the improvement of elongation, the steel plate (following TRIP steel) using the strain induced transformation of retained austenite, etc. are invented, for example, it is indicated by JP,61-157625,A. However, a lot of Si addition of the usual TRIP steel board is indispensable, and since the molten zinc plating nature of a steel sheet surface gets worse, an applicable member is restricted. In order to secure high intensity in retained austenite steel, a lot of C addition is required, and there is a problem of welding of a nugget crack etc.
[0003]Although the invention aiming at Si reduction of retained austenite TRIP steel is indicated by JP,2000-345288,A about the molten zinc plating nature of the steel sheet surface, In this invention, although improvement in molten zinc plating nature and ductility could be desired, since an improvement of the above-mentioned weldability was not able to be expected and also it served as very high yield stress in the TRIP steel board of 980 or more MPa of tensile strength, there was a problem that the shape freezing nature in the time of a press, etc. got worse. Although the Dual Phase steel (henceforth DP steel) which contains a ferrite which is indicated by JP,57-155329,A as art of reducing yield stress is known from the former, The molten zinc plating high intensity steel plate which has sufficient moldability was not necessarily realized.
[0004]
[Problem(s) to be Solved by the Invention]This invention solves the problem of the above conventional technologies, and makes it SUBJECT to realize a molten zinc plating high intensity steel plate excellent in the moldability, and a manufacturing method for the same on a scale of industrial.

[0005]
[Means for Solving the Problem]First, technical thought of this invention is explained. This invention persons are making balance of optimization of a steel composition, i.e., Si, aluminum, and Ts into a specific range, and adjusting especially aluminum addition, as a result of examining wholeheartedly a molten zinc plating high intensity steel plate excellent in a moldability, In DP steel with low yield stress, it found out that a molten zinc plating high intensity steel plate which can secure elongation more than the former could be manufactured industrially. Even if molten zinc plating nature was raised and it performed alloying plating further by its ductility's improving to such an extent that a steel plate of this invention applies just like [conventional] remains austenitic steel, and reducing Si, that the characteristic deteriorates realized few high intensity steel plates. 5% or less of retained austenite contained unescapable was permitted, and it was considered as DP steel which does not contain retained austenite substantially so that neither delayed fracture nor a problem of fabricating brittleness might arise.
[0006]Although the high intensity steel plate of this invention can realize tensile strength of 590Mpa to 1500Mpa, it does a remarkable effect so with a high intensity steel plate of 980 or more Mpa. This invention is based on the above technical thought, and makes the contents of the following indicated to a claim the gist.
(1) At mass %, it is C. : 0.01 to 0.30%, Si : [0.005 to 0.3%,] Mn: 0.1 to 3.3%, P : 0.001 to 0.06%, S : 0.001 to 0.01%, :0.0005-0.01%, aluminum : N Contain 0.25 to 1.8%, A molten zinc plating high intensity steel plate excellent in a moldability, wherein it consists of the remainder Fe and an inevitable impurity, mass % of Si, Mn, and aluminum satisfies following (A) type further and a metal texture contains a ferrite and martensite.
(0.0012x [TS target value]-0.29-[Si])/1.45 -- < -- aluminum<1.5-3* [Si] ... (A) -- here -- [TS target value] -- an intensity designed value of a steel plate -- a unit -- Mpa and [Si] -- mass [of Si] % [0007](2) A molten zinc plating high intensity steel plate excellent in a moldability given in (1) furthermore characterized by containing two of one sort or V:0.01 to 0.1%, Ti:0.01-0.2%, and Nb:0.005-0.05% of sorts or more.
(3) A molten zinc plating high intensity steel plate excellent in a moldability given in (1) furthermore characterized by containing Mo:0.05-0.5%, or (2).
(4) Furthermore, it is Ca. : 0.0005 to 0.005%, REM: Molten zinc plating high intensity steel plate excellent in a moldability given in (1) containing two of one sort or 0.0005 to 0.005% of sorts thru/or (3).
[0008](5) A molten zinc plating high intensity steel plate excellent in a moldability given in (1) furthermore characterized by containing B:0.0005 to 0.002% thru/or (4).
Are a manufacturing method of a high intensity steel plate of a statement, and it heats in a molten zinc plating process (6), (1) to (5) in one or more Ac(s) temperature region of 3+100 ** or less of Ac (s), A manufacturing method of a molten zinc plating high intensity steel plate which was excellent in a moldability cooling to a temperature region 600 ** or less with a cooling rate at 1 **/s or more after holding 30 or less minutes 30 seconds or more. Ac1 and Ac3 are values calculated by formula of Andrews based on here by ******. A galvanized steel sheet of this invention contains a hot-dip zinc-coated steel sheet in which a usual hot-dip zinc-coated steel sheet and alloying treatment were made.

[0009]
[Embodiment of the Invention]An embodiment of the invention is described in detail below. First, the ingredient of the high intensity steel plate of this invention and the reason for limitation of a metal texture are explained. C is an indispensable ingredient as a basic element which stabilizes martensite from a viewpoint of intensity reservation. C is not [intensity] satisfied with less than 0.01%, and a martensitic phase is not formed. Since degradation of weldability is caused, it cannot be used as an industrial material, except that intensity goes up too much and ductility runs short, if it exceeds 0.3%. Therefore, the range of C in this invention is made into 0.01 to 0.3%, and is 0.03 to 0.15% preferably. Mn is an element which delays generation of carbide in the viewpoint of intensity reservation in addition to being added, and is an element effective in generation of a ferrite. Intensity is not satisfied with less than 0.1%, and it becomes insufficient forming Mn of a ferrite, and ductility deteriorates.
[0010]Ductility runs short and it cannot be used as an industrial material except that a lot of martensite will generate, and will cause an intensity rise and the variation in a product will become large by this, since hardenability increases more than needed if Mn addition exceeds 3.3%. Therefore, the range of Mn in this invention was made into 0.1 to 3.3%. Although Si is an element which is usually added for ductile reservation in addition to adding in the viewpoint of intensity reservation, molten zinc plating nature will deteriorate by addition exceeding 0.2%. Therefore, 0.1% or less of the range of Si in this invention is desirable, when making it into 0.3% or less and thinking molten zinc plating nature as important further. P is added according to an intensity level required as an element which raises the intensity of a steel plate. However, local ductility is degraded in order to carry out a segregation to a grain community with many additions. Weldability is degraded. Therefore, P upper limit may be 0.06%. It is because it is connected with the cost hike at the time of refinement in a steel-manufacture stage that having made the minimum into 0.001% makes it decrease more.
[0011]S is an element which degrades local ductility and weldability by generating MnS, and is an element it is more desirable not to exist in steel. Therefore, a maximum is made into 0.01%. It is because it is connected with the cost hike at the time of refinement in a steel-manufacture stage that having made the minimum into 0.001% makes it decrease more like P. aluminum is the most important element in the system from a book. aluminum promotes generation of a ferrite by addition, and acts effective in the improvement in ductility, and also it is an element which does not degrade molten zinc plating nature by abundant addition, either. It acts also as a deoxidizing element. Even if it added aluminum too much on the other hand, in order that [that 0.25% or more needs to be aluminum added in order to raise ductility] the above-mentioned effect might be saturated and might embrittle steel on the contrary, it made the maximum 1.8%. Although N is an element contained unescapable, since its AlN precipitation amount increases and it not only degrades prescription nature, but it decreases the effect of aluminum addition when it contains in a large quantity not much, 0.01% or less of its content is preferred. As for reducing N superfluously, since the cost like a steelworker increases, it is preferred to usually control to about 0.0005% or more.
[0012]In order to consider it as a high intensity steel plate, generally a lot of element addition is needed, and ferrite generation is controlled. For this reason, since the ferrite molar fraction of an organization decreases and the molar fraction of the 2nd phase increases, in DP steel of 980 or more

MPa, elongation falls remarkably especially. Although many Si addition and Mn reduction are used for this improvement, since intensity reservation becomes difficult, in the steel plate made into the purpose of this invention, as for the former, molten zinc plating nature's deteriorating and the latter cannot be used. then, it found out that artificers can find out the effect of aluminum as a result of inquiring wholeheartedly, they can secure sufficient ferrite molar fraction when it has aluminum and Si which fill the relation of a formula (A), and TS balance, and the outstanding elongation could be secured.

(0.0012x [TS target value]-0.29-[Si])/1.45 -- < -- aluminum<1.5-3* [Si] ... (A) -- here -- [TS target value] -- the intensity designed value of a steel plate -- a unit -- MPa. [Si] is mass [of Si] %.

[0013]It is not enough in order to raise ductility, if aluminum addition will be (0.0012x [TS target value]-0.29-[Si]) / less than [1.45], and if 1.5-3* [Si] is exceeded, molten zinc plating nature will get worse. The invention range of the molten zinc plating high intensity steel plate in this invention is shown in drawing 1. The reason for being characterized by the metal texture of this invention containing a ferrite and martensite is that it becomes the steel plate excellent in intensity ductility balance when taking such an organization. A ferrite here puts a polygonal ferrite and BEINE tick ferrite, and an effect does not change in the martensite which annealed at the temperature of 600 ** or less besides the martensite obtained by quenching usual in martensite. Since secondary elaboration brittleness and the delayed fracture characteristic will get worse if austenite remains during an organization, in this invention, 3% or less of retained austenite which exists unescapable is permitted, and retained austenite is not included substantially. V, Ti, and Nb may be added for the purpose of intensity reservation in V:0.01 to 0.1%, Ti:0.01-0.2%, and Nb:0.005-0.05% of the range.

[0014]Mo is an element which has an effect in intensity reservation and hardenability. At 0.05% or less, strengthening of Mo cannot use the minimum addition, and also quenching performance peculiar to Mo is not demonstrated, and sufficient martensite is not formed, but it becomes insufficient strength. Since addition of excessive Mo controlled the ferrite generation in DP, and ductile degradation was caused and also molten zinc plating nature might be degraded, the maximum was made into 0.5%. Ca and REM are the purposes of inclusion control and a hole expanding improvement, and may be added in Ca:0.0005-0.005% and REM:0.0005-0.005% of the range. B may add in B:0.0005 to 0.002% of range hardenability reservation and for the purpose of increase of effective aluminum by BN.

[0015]Although there are Sn etc. as inevitable impurities, even if it contains these elements in the range below 0.01 mass %, for example, the effect of this invention is not spoiled. The reason for limitation of the manufacturing process of this invention is as follows. The raw material used by this invention is the hot rolled sheet steel manufactured through the usual hot-rolling process. These are obtained by passing through the heat history which is carried out or states pickling and cold-rolling to direct and the following as it is. In a molten zinc plating process, it anneals at the temperature of one or more Ac(s) and 3+100 ** or less of Ac(s). Less than [this], **** becomes uneven. On the other hand, in the temperature beyond this, since ferrite generation is controlled by big and rough-ization of austenite, degradation of elongation is caused. As for an economical point to annealing temperature, 900 ** or less is desirable. Under the present circumstances, in order to cancel stratified ****, 30 seconds or more need to be held, but even if it exceeds 30 minutes, an effect is saturated and

productivity also falls. Therefore, 30 or less minutes takes 30 seconds or more. Then, cooling finishing temperature is made into the temperature of 600 ** or less. If it exceeds 600 **, austenite will remain easily and it will become easy to produce the problem of secondary elaboration nature and delayed fracture. Even if this invention performs hole expansion property and tempering treatment 600 ** or less aiming at a brittle improvement after this heat treatment, an effect does not change.
[0016]
[Example]Rolling-up heat treatment of hot-rolling was reproduced by manufacturing the steel which has the component composition shown in Table 1 and 2 with a vacuum melting furnace, reheating to 1200 ** after cooling and solidification, performing finish rolling at 880 **, and holding at 600 ** after cooling for 1 hour. grinding removes a scale for the obtained hot-rolling board -- 70% -- it cold-rolled. After performing annealing for 770 **x 60 seconds, cooling to 350 ** using a continuous-annealing simulator after that and holding at the temperature for 10 to 600 seconds, it cooled to the room temperature further. The direction tension of L of the JIS No. 5 test piece for tensile test estimated tractive characteristics, and the product of TS(MPa) xEL (%) made the above good for 18000MPa%. The metal texture was observed with the optical microscope. A ferrite is the Nay Taal etching. Martensite was observed by REPERA etching.
[0017]The case where performed molten zinc plating, checked the adhesion condition of plating visually, and it had adhered uniformly in the area beyond inner 90% of a plated surface by the molten zinc plating simulator after giving the same annealing conditions as the above was considered as fitness "O", and, as for plating performance, what has a defect selectively was made into "x." The steel plate by this invention can manufacture the high intensity steel plate which is excellent in molten zinc plating nature, and excels [all] in intensity and ductility balance so that it may accept from the result of Table 3 and 4. Plating evaluation is x or the value of TSxEL the comparative example from which the component range of Table 3 and 4 separates from the range of this invention, and the comparative example (CI, CJ) with which the range of aluminum is not satisfied of the (A) type, on the other hand, indicate intensity and ductility balance to be is less than [18000Mpa%].
[0018]
[Table 1]

表1

鋼種記号		TS狙い	C	Si	Mn	P	S	N	Al	V	Ti	Nb	Mo	Ca	B	REM
A	発明例		0.013	0.171	0.44	0.020	0.008	0.0073	1.057	—	—	—	0.22	—	—	—
B	〃		0.014	0.221	2.28	0.012	0.005	0.0095	1.365	—	—	—	—	—	—	—
C	〃		0.022	0.100	1.88	0.027	0.007	0.0026	1.167	—	—	—	—	—	—	—
D	〃		0.023	0.251	2.33	0.047	0.008	0.0078	0.252	—	—	—	—	—	—	—
E	〃		0.028	0.293	2.05	0.042	0.004	0.0017	0.570	—	—	—	—	—	—	—
F	〃		0.043	0.131	1.74	0.006	0.002	0.0051	1.112	—	—	—	—	—	—	—
G	〃		0.046	0.122	2.67	0.015	0.002	0.0064	0.749	—	—	—	—	—	—	—
H	〃		0.049	0.161	2.50	0.012	0.008	0.0061	0.457	—	—	—	—	—	—	—
I	〃		0.060	0.068	0.88	0.003	0.007	0.0020	0.426	—	—	—	—	—	—	—
J	〃		0.063	0.006	1.40	0.030	0.008	0.0033	1.654	—	—	—	—	—	—	—
K	〃		0.068	0.180	1.69	0.011	0.010	0.0087	1.007	—	—	—	—	—	—	—
L	〃		0.076	0.033	0.62	0.023	0.005	0.0078	1.204	—	—	—	—	—	—	—
M	〃		0.079	0.130	1.21	0.016	0.001	0.0040	0.748	—	—	—	—	0.003	—	—
N	〃		0.080	0.070	1.23	0.057	0.002	0.0009	1.179	—	—	—	—	—	—	—
O	〃		0.081	0.117	1.34	0.009	0.005	0.0090	1.041	—	—	—	—	—	—	—
P	〃		0.088	0.205	0.38	0.056	0.003	0.0015	0.677	—	—	—	—	—	—	—
Q	〃		0.095	0.247	2.09	0.008	0.007	0.0029	0.892	—	—	—	—	—	—	—
R	〃		0.100	0.120	0.53	0.022	0.004	0.0022	0.567	—	—	—	—	—	—	—
S	〃		0.101	0.228	2.68	0.006	0.008	0.0080	1.712	—	—	—	—	—	—	—
T	〃		0.102	0.157	0.10	0.080	0.007	0.0034	0.639	—	—	—	—	—	—	—
U	〃		0.118	0.128	2.99	0.054	0.001	0.0024	0.962	—	—	—	—	—	—	—
V	〃		0.119	0.179	1.15	0.041	0.006	0.0037	0.880	—	—	—	—	—	0.001	—
W	〃		0.128	0.244	2.03	0.027	0.004	0.0041	0.442	—	—	—	—	—	—	—
X	〃		0.128	0.213	1.93	0.036	0.007	0.0036	0.828	—	—	—	—	—	—	0.002
Y	〃		0.142	0.210	2.95	0.001	0.003	0.0085	1.265	—	—	—	—	—	—	—
Z	〃		0.160	0.272	2.41	0.059	0.009	0.0064	1.718	—	—	—	—	—	—	—
AA	〃		0.163	0.048	2.19	0.042	0.005	0.0007	1.634	—	—	—	—	—	—	—
AB	〃		0.164	0.114	1.54	0.013	0.009	0.0023	1.163	—	—	—	—	—	—	—
AC	〃		0.166	0.170	2.35	0.026	0.007	0.0060	0.527	—	—	—	—	—	—	—
AD	〃		0.173	0.146	1.24	0.050	0.005	0.0063	1.618	—	—	—	—	—	—	—
AE	〃		0.174	0.271	2.02	0.053	0.005	0.0085	1.680	—	—	—	—	—	—	—
AF	〃		0.192	0.149	2.37	0.038	0.003	0.0085	0.360	—	—	—	—	—	—	—
AG	〃		0.203	0.010	2.62	0.026	0.009	0.0052	0.900	—	—	—	—	—	—	—
AH	〃		0.207	0.109	2.97	0.015	0.004	0.0083	0.991	—	—	—	—	—	—	—
AI	〃		0.214	0.120	0.79	0.006	0.003	0.0081	0.342	—	—	—	—	—	—	—
AJ	〃		0.219	0.191	1.88	0.022	0.003	0.0023	0.513	—	—	—	—	—	—	—
AK	〃		0.222	0.211	2.46	0.004	0.002	0.0096	1.034	—	—	—	—	—	—	—
AL	〃		0.228	0.156	0.43	0.059	0.009	0.0058	0.514	—	—	—	—	—	—	—
AM	〃		0.227	0.006	1.15	0.040	0.003	0.0027	0.436	—	—	—	—	—	—	—
AN	〃		0.229	0.025	0.86	0.010	0.008	0.0051	1.436	—	—	—	—	—	—	—
AO	〃		0.233	0.006	2.47	0.008	0.010	0.0044	0.332	—	—	—	—	—	—	—
AP	〃		0.233	0.195	1.91	0.013	0.002	0.0032	1.430	—	0.08	—	—	—	—	—
AQ	〃		0.253	0.134	0.37	0.029	0.003	0.0087	0.789	—	—	—	—	—	—	—
AR	〃		0.261	0.276	0.43	0.043	0.009	0.0090	0.815	0.05	—	—	—	—	—	—
AS	〃		0.266	0.151	2.68	0.055	0.006	0.0075	1.004	—	—	—	—	—	—	—
AT	〃		0.267	0.201	2.20	0.052	0.001	0.0054	0.870	—	—	0.02	—	—	—	—
AU	〃		0.271	0.225	0.65	0.019	0.006	0.0047	1.023	—	—	—	—	—	—	—
AV	〃		0.280	0.088	1.48	0.036	0.004	0.0043	0.507	—	—	—	—	—	—	—
AW	〃		0.291	0.116	0.58	0.027	0.005	0.0041	1.445	—	—	—	—	—	—	—
AX	〃		0.300	0.289	0.47	0.038	0.005	0.0005	1.391	—	—	—	—	—	—	—

[Table 2]

表2

鋼種記号		TS狙い	C	Si	Mn	P	S	N	Al	V	Ti	Nb	Mo	Cu	B	REM
AY	比較例		0.008	0.202	0.43	0.007	0.010	0.0063	1.778	—	—	—	—	—	—	—
AZ	〃		0.320	0.113	2.92	0.003	0.006	0.0007	0.462	—	—	—	—	—	—	—
BA	〃		0.166	0.323	2.64	0.056	0.009	0.0049	0.894	—	—	—	—	—	—	—
BB	〃		0.113	0.083	0.09	0.049	0.001	0.0006	0.527	—	—	—	—	—	—	—
BC	〃		0.164	0.285	3.44	0.020	0.004	0.0041	1.247	—	—	—	—	—	—	—
BD	〃		0.125	0.267	2.06	0.070	0.003	0.0009	0.337	—	—	—	—	—	—	—
BE	〃		0.058	0.131	2.50	0.002	0.020	0.0069	0.377	—	—	—	—	—	—	—
BF	〃		0.026	0.145	0.15	0.011	0.010	0.0200	0.273	—	—	—	—	—	—	—
BG	〃		0.196	0.187	1.95	0.018	0.004	0.0083	0.240	—	—	—	—	—	—	—
BH	〃		0.223	0.220	2.78	0.005	0.003	0.0022	0.190	—	—	—	—	—	—	—
BI	発明例	480	0.018	0.176	1.31	0.032	0.005	0.007	0.81	—	—	—	—	—	—	—
BJ	〃	500	0.018	0.112	2.35	0.043	0.006	0.010	0.99	—	—	—	—	—	—	—
BK	〃	540	0.027	0.074	2.87	0.016	0.003	0.005	0.43	—	—	—	—	—	—	—
BL	〃	550	0.030	0.177	1.11	0.016	0.009	0.005	0.95	—	—	—	—	—	—	—
BM	〃	560	0.032	0.186	2.78	0.029	0.006	0.003	0.93	—	—	—	—	—	—	—
BN	〃	570	0.044	0.100	2.34	0.039	0.002	0.008	0.30	—	—	—	—	—	—	—
BO	〃	580	0.058	0.171	2.06	0.056	0.007	0.003	0.97	—	—	—	—	—	—	—
BP	〃	580	0.058	0.160	0.17	0.033	0.002	0.008	0.90	—	—	—	—	—	—	—
BQ	〃	590	0.071	0.196	1.42	0.037	0.003	0.005	0.55	—	—	—	—	—	—	—
BR	〃	640	0.082	0.089	1.15	0.016	0.004	0.005	1.14	—	—	—	—	—	—	—
BS	〃	680	0.082	0.081	2.93	0.040	0.001	0.003	1.05	—	—	—	—	—	—	—
BT	〃	700	0.093	0.055	1.84	0.007	0.008	0.007	0.50	—	—	—	—	—	—	—
BU	〃	760	0.100	0.013	0.70	0.002	0.008	0.004	0.81	—	—	—	—	—	—	—
BV	〃	780	0.110	0.122	2.64	0.057	0.009	0.002	0.73	—	—	—	—	—	—	—
BW	〃	800	0.120	0.084	0.17	0.010	0.010	0.004	0.87	—	—	—	—	—	—	—
BX	〃	840	0.120	0.148	0.19	0.016	0.008	0.006	1.00	—	—	—	—	—	—	—
BY	〃	900	0.134	0.047	0.19	0.042	0.010	0.007	1.11	—	—	—	—	—	—	—
BZ	〃	920	0.140	0.042	1.71	0.021	0.006	0.005	0.78	—	—	—	—	—	—	—
CA	〃	950	0.142	0.116	0.27	0.046	0.007	0.006	0.85	—	—	—	—	—	—	—
CB	〃	980	0.150	0.107	1.76	0.059	0.006	0.009	0.88	—	—	—	—	—	—	—
CC	〃	1280	0.210	0.153	1.20	0.025	0.005	0.002	0.78	—	—	—	—	—	—	—
CD	〃	1320	0.235	0.176	2.73	0.051	0.008	0.004	0.85	—	—	—	—	—	—	—
CE	〃	950	0.122	0.275	0.27	0.046	0.007	0.006	0.85	—	—	—	—	—	—	—
CF	〃	1180	0.150	0.107	2.99	0.059	0.006	0.009	0.88	—	—	—	—	—	—	—
CG	〃	1200	0.210	0.299	1.20	0.025	0.005	0.002	0.60	—	—	—	—	—	—	—
CH	〃	1480	0.289	0.186	2.06	0.052	0.004	0.008	0.91	—	—	—	—	—	—	—
CI	比較例	720	0.099	0.188	0.45	0.046	0.002	0.003	0.12	—	—	—	—	—	—	—
CJ	〃	880	0.130	0.186	2.39	0.051	0.006	0.003	1.30	—	—	—	—	—	—	—

[Table 3]

表3

	実験記号	TS	EL	TS×EL	亜鉛メッキ性
発明例	1	476	37.9	18040	○
発明例	2	488	36.9	18007	○
発明例	3	520	34.7	18044	○
発明例	4	539	33.8	18218	○
発明例	5	544	33.1	18006	○
発明例	6	577	33.2	19156	○
発明例	7	576	32.5	18720	○
発明例	8	585	31.2	18252	○
発明例	9	622	29.5	18349	○
発明例	10	612	29.8	18238	○
発明例	11	635	29.4	18669	○
発明例	12	622	30.1	18722	○
発明例	13	638	28.5	18183	○
発明例	14	652	28.1	18321	○
発明例	15	685	27.2	18632	○
発明例	16	734	26.4	19378	○
発明例	17	795	24.5	19478	○
発明例	18	789	24.2	19094	○
発明例	19	825	22.2	18315	○
発明例	20	788	23.5	18518	○
発明例	21	853	21.5	18340	○
発明例	22	832	22.4	18637	○
発明例	23	874	21.2	18529	○
発明例	24	873	23.2	20254	○
発明例	25	953	19.2	18298	○
発明例	26	987	18.5	18260	○
発明例	27	979	18.4	18014	○
発明例	28	988	18.6	18377	○
発明例	29	993	18.3	18172	○
発明例	30	1005	18.0	18090	○
発明例	31	1012	17.9	18115	○
発明例	32	1033	17.5	18078	○
発明例	33	1028	17.6	18093	○
発明例	34	1035	17.4	18009	○
発明例	35	1002	18.1	18136	○
発明例	36	1088	17.4	18931	○
発明例	37	1078	18.2	19620	○
発明例	38	1031	18.0	18558	○
発明例	39	1022	17.9	18294	○
発明例	40	1033	18.4	19007	○
発明例	41	1088	17.0	18496	○
発明例	42	1112	16.5	18348	○
発明例	43	1099	17.2	18903	○
発明例	44	1158	16.2	18760	○
発明例	45	1225	15.8	19355	○
発明例	46	1204	15.7	18903	○
発明例	47	1240	16.0	19840	○
発明例	48	1222	16.1	19674	○
発明例	49	1352	15.4	20821	○
発明例	50	1476	13.5	19926	○

[Table 4]

表4

	実験記号	TS	EL	TS×EL	亜鉛メッキ性
比較例	51	335	33.2	11122	○
比較例	52	1623	9.2	14932	○
比較例	53	985	19.5	19208	×
比較例	54	885	18.5	16373	○
比較例	55	1235	10.2	12597	○
比較例	56	795	20.1	15980	○
比較例	57	587	26.5	15556	○
比較例	58	557	31.2	17378	○
比較例	59	623	28.1	17506	○
発明例	60	476	37.9	18040	○
発明例	61	508	36.9	18745	○
発明例	62	551	33.0	18183	○
発明例	63	549	33.1	18172	○
発明例	64	568	32.5	18460	○
発明例	65	582	31.9	18566	○
発明例	66	591	30.9	18262	○
発明例	67	584	31.2	18221	○
発明例	68	605	29.9	18090	○
発明例	69	632	30.1	19023	○
発明例	70	688	28.7	19746	○
発明例	71	695	27.2	18904	○
発明例	72	743	24.8	18426	○
発明例	73	812	23.2	18838	○
発明例	74	825	22.8	18810	○
発明例	75	852	21.5	18318	○
発明例	76	905	20.1	18191	○
発明例	77	899	20.5	18430	○
発明例	78	934	19.5	18213	○
発明例	79	1024	18.2	18637	○
発明例	80	1320	14.9	19668	○
発明例	81	1400	13.5	18900	○
発明例	82	965	19.9	19204	○
発明例	83	1230	15.8	19434	○
発明例	84	1220	15.3	18666	○
発明例	85	1520	12.2	18544	○
比較例	86	750	22.2	16650	○
比較例	87	899	20.2	18160	×

[0019]

[Effect of the Invention]By according to this invention, making balance of Si, aluminum, and Ts into a specific range, and adjusting especially aluminum addition. In DP steel with low yield stress, a molten zinc plating high intensity steel plate excellent in the moldability which can secure the elongation more than the former, and a manufacturing method for the same can be realized on a scale of industrial, and an industrially useful remarkable effect is done so.

[Translation done.]